



International Journal of Surgery Case Reports

journal homepage: www.casereports.comDealing with symptomatic stenosis of the subclavian artery: Open or endovascular approach? A case report[☆]Hozan Mufty^{a,*}, Alfred Janssen^b, Stijn Schepers^a^a Department of Vascular Surgery, AZ Damiaan, Ostend, Belgium^b Surgery Department, AZ Damiaan, Ostend, Belgium

ARTICLE INFO

Article history:

Received 10 February 2014

Received in revised form 6 April 2014

Accepted 30 April 2014

Available online 6 June 2014

Keywords:

Subclavian bypass

Subclavian artery stenosis

Cross over bypass

ABSTRACT

INTRODUCTION: Stenosis of the subclavian artery is uncommon and it rarely causes symptoms. Only symptomatic patients should be treated.**PRESENTATION OF CASE:** We report a case of chronic left upper limb ischemia caused by subclavian artery stenosis after repetitive clavicular fixation. The stenosis was first treated with carotid-subclavian bypass and soon followed by angioplasty and stenting of the subclavian artery because of occlusion of the bypass. Finally, failure of these procedures necessitated a subclavian-axillary crossover bypass.**DISCUSSION:** Both extra-anatomic bypass and percutaneous transluminal angioplasty are safe and effective. If feasible, many authors use endovascular treatment. According to literature, extra-anatomic bypass still remains the first choice of treatment for symptomatic patients. However, the introduction of routine stent implantation is equalling these results. Because of its lower long-term patency rate, endovascular treatment is favorable for patients at high risk.**CONCLUSION:** Our case is a good example of difficulties involved in choosing the best treatment option for subclavian artery stenosis.© 2014 The Authors. Published by Elsevier Ltd. on behalf of Surgical Associates Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

1. Introduction

Subclavian artery stenosis or occlusion has a low prevalence (1.9%) and is asymptomatic in most cases.¹ Not all symptomatic patients require treatment.² Similar to the treatment of peripheral arterial disease in the lower limb (TASC II),³ we would expect endovascular revascularisation to be the preferable treatment option in subclavian artery lesions.³ However, even for large centers, it is difficult to compare results of patients with subclavian artery stenosis treated in a uniform way. No randomized controlled trials were found in a PubMed literature search. We present a case report of a patient with upper left limb ischemia caused by subclavian artery stenosis after repetitive left clavicle trauma, treated in different ways. In the discussion we give a brief systematic review of the open and endovascular treatment options with short- and

long-term patency rates and possible complications. In this way, we reflect our case to literature.

2. Presentation of case

In May 2009, a 43-year old male patient was referred to our department with ischemic symptoms (pulseless, palor and rest pain) of the left hand during rehabilitation. The patient had received a cervical disk prosthesis in 2001. Four months prior to referral to our department, he had presented to the emergency department with a midclavicular fracture on the left side after a fall. This was initially treated with plate and screw osteosynthesis. During rehabilitation, the patient presented with a broken osteosynthesis plate causing intolerable pain. A new plate was placed. This was complicated by infection of the osteosynthesis material. The material was removed and the fracture subsequently evolved to pseudarthrosis.

Duplex ultrasound showed low flow in the left axillary and brachial artery. Digital subtraction angiography (DSA) confirmed total occlusion of the left subclavian artery, starting after the origin of the left vertebral artery, with good collateral circulation but with slow arterial flow to the left arm (Fig. 1).

A left carotid-subclavian bypass was performed using a six-millimeter PTFE vascular graft prosthesis (Maquet Cardiovascular, Rastatt, Germany). Postoperatively, good radial and brachial pulsations were obtained without neurologic complaints. The postoperative course was uncomplicated and the patient was

Abbreviations: DSA, digital subtraction angiography; COB, cross over bypass; CSB, carotid-subclavian bypass; CST, carotid-subclavian transposition; PTA, percutaneous transluminal angioplasty.

[☆] This paper was presented at the fourteenth Belgian surgical week, Ostend, Thermae Palace Hotel, 1–4 May 2013 and at the 'werkgroep endovasculaire heelkunde', Antwerp, 13 June 2013.

* Corresponding author at: Department of Surgery, AZ Damiaan, Gouwelozeestraat 100, 8400 Ostend, Belgium. Tel.: +32 485866338; fax: +32 59414220.

E-mail address: hozan.mufty@hotmail.com (H. Mufty).

<http://dx.doi.org/10.1016/j.ijscr.2014.04.032>

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Fig. 1. DSA showing a good collateral circulation developed after occlusion of the left subclavian artery with reinjection in the distal part of the subclavian artery.

prescribed dipyridamole 150 mg twice daily and acetylsalicylic acid 500 mg once daily. The patient had an eventless recovery and was discharged by the fifth day postoperatively.

Two and a half years later, in January 2012, the patient presented with recurrence of the ischemic symptoms and with occlusion of the carotid subclavian bypass on DSA. Antegrade recanalisation of the subclavian artery stenosis through femoral access was unsuccessful. Subsequently, denudation of the brachial artery was performed with successful recanalisation of the left subclavian artery using an Opta® Pro 6 mm × 40 mm balloon (Cordis, Johnson&Johnson, Bridgewater, New Jersey, USA) and a Viabahn® 7 mm × 100 mm endoprosthesis (W.L. Gore & Associates, Inc., Flagstaff, Arizona, USA). Distal radial pulsations were present postoperatively and the patient was asymptomatic again. The patient was discharged one day postoperatively. Dipyridamole and acetylsalicylic acid were stopped and clopidogrel 75 mg once daily was started. Nine months later, in September 2012, the patient again presented with persistent ischemic complaints in the left arm. DSA showed occlusion of the stent in the subclavian artery and the already known thrombosis of the carotid-subclavian bypass (Fig. 2). A new percutaneous transluminal angioplasty was attempted, though the procedure was neither antegradely nor retrogradely successful. Three months later, a subclavian-axillary crossover bypass was performed under general anesthesia using a seven millimeter Fluoropassiv armed graft (Vascutech, Terumo nv, Tokyo, Japan). A subcutaneous presternal tunnel was created by blunt finger dissection. The procedure was uncomplicated and the ischemic symptoms disappeared postoperatively. The patient was discharged on the second postoperative day. At this time, only acetylsalicylic acid 80 mg once daily was given as anticoagulation therapy. The patient didn't suffer any ischemic complaints since.

3. Discussion

Subclavian stenosis with or without subclavian steal syndrome is relatively rare. Only symptomatic patients present for treatment, which makes it difficult to estimate its incidence or prevalence rate.¹



Fig. 2. DSA showing thrombosis of the CSB and occlusion of the stent. Reinjection by a diffuse collateral circulation occurs in the third part of the axillary artery.

The left side is more often affected (80–82.3%).^{2,4} If symptomatic, symptoms may vary from upper limb ischemia (10–92%) to signs of vertebrobasilar insufficiency (51–84%),^{2,4–7} coronary-subclavian steal syndrome or future coronary bypass surgery (4.7–21%)^{2,5,6} and less common, signs of hemispheric involvement (10%).⁴ Only symptomatic patients should be treated.²

Our patients suffered ischemic complaints of the left upper limb either due to intima hyperplasia or extrinsic compression caused by repetitive trauma in this region. Generally, surgical decompression (i.e. clavicle, cervical and/or first rib resection) is advised in vascular thoracic outlet syndrome.⁸ We did not perform first rib resection because of the high risk surgery in this region after repetitive fixation and infection.

Possible constructions of extra-anatomic bypass grafting are carotid-subclavian bypass (CSB), carotid-subclavian transposition (CST) and cross over bypass (COB) (axillo-axillary or subclavian-subclavian bypass). There are no large studies about these procedures ($n = 39$ – 61) and these studies show good long-term primary and secondary rates ranging from 82% to 100%.^{7,9,10}

Studies comparing CSB, SCT and COB show a significant shorter operating time for SCT ($p < 0.001$) and a significant better long-term patency for SCT (100% at 10 years versus 52.2% for CSB and 63.7% for COB, $p < 0.005$). In these procedures a trend for better patency was seen in prosthetic graft versus autologous vein graft ($p < 0.2$).⁴ In our patient we preferred a cross-over bypass, although a valuable alternative option was a redo autologous CSB.

Another study comparing 20 CSB with 20 CST procedures showed a patency rate of 100% for SCT and 66% for CSB at 6 years.¹¹

In the largest study of percutaneous transluminal angioplasty (PTA) procedures, published by Henry et al. ($n = 237$), primary and secondary patency at ten years were 78% and 85%. The study showed remarkable results for a comparison between the primary and secondary patency rate without using a stent (67% and 76%) versus the patency rates with a stent (90% and 97%) ($p < 0.01$). Seventy-five percent of the patients received a stent in this study group.⁵ Patel et al. routinely performed PTA procedures with stenting in patients with subclavian and innominate artery obstruction ($n = 177$). Similar results were found in this study with a primary

patency rate at five years of 84% and a secondary patency rate at four years of 98%.⁶ The routine use of stent implantation seems to improve long-term results.⁵

It is difficult to compare PTA with open extra-anatomic procedures because subclavian artery stenosis requiring treatment rarely occurs. Moreover, comparisons are further complicated by the heterogeneity of treatment options and material used.

The most recent comparative study was established in 2007 by Aburahma et al.¹² They compared findings of 51 patients who underwent CSB for subclavian disease with those of 121 patients who underwent PTA with or without stenting. A significant better primary patency rate was seen in the CSB group versus the PTA/stent group at 1, 3 and 5 years, 100%, 98% and 96% versus 93%, 78% and 70% respectively ($p < 0.0001$).

Although PTA/stent is a minimally invasive technique, a comparable complication rate is seen in the PTA/stent group (2.9–14.9%)^{5,14} versus the bypass group (5.9–14.2%).^{7,12,13} Our patient underwent an uncomplicated postoperative course and is still doing well with a patent bypass eleven months after the last surgical treatment.

4. Conclusion

Subclavian artery stenosis is a rare condition causing symptoms in only a minority of patients. Only symptomatic patients should be treated. Studies comparing extra-anatomic bypass with PTA/stenting show different kinds of complications but a comparable complication rate. Short-term results for these groups are also comparable. However, long-term results show a better patency rate in favor of the extra-anatomic bypass. The introduction of routine stent implantation is equalling these results. Our case is a good example of difficulties involved in choosing the best treatment option for subclavian artery stenosis.

Conflicts of interest

The authors declare that they have no competing interests. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethical approval

Written informed consent was obtained from the patient for publication of this case report and any accompanying figures. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Funding

None declared.

Authors' contributions

Hozan Mufty wrote the paper, collected the data and analysed the study. Alfred Janssen has interpreted the data and approved the final version of submitted manuscript. Stijn Schepers wrote the paper, revised the critical important intellectual content, collected the data, and surgeon for this work.

Key learning point

- Our case is a good example of difficulties involved in choosing the best treatment option for subclavian artery stenosis.

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